Investigating the need for the development of E-modules mathematics physics for students

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Abstract

This research is motivated by the difficulties of students in studying Mathematics Physics II with Fourier series material because the main source books used are all in English. In addition, it is also known that the development of e-modules for the Physics Mathematics II course has never been done before. Therefore, the researchers conducted this investigation to know how much students need the development of e-modules for the Fourier series material in the Mathematics Physics II course. The data was obtained in the form of quantitative data and qualitative data using a questionnaire sheet and student interviews. Quantitative data was analyzed by descriptive statistical analysis test, while qualitative data was analyzed using the Miles & Huberman approach. Through the results of this study, it was found that most of the students expressed their need for the development of the e-module in Mathematics Physics II for Fourier series material. The novelty of this study is that the material used is Fourier series material which has never been studied by previous research.

Keywords: Education; E-module; investigation; mathematics; physics.

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1. INTRODUCTION

Education is one of the needs that must be met by humans. Through education, humans are formed into quality human resources (Annisa et al., 2020; Rista & Ariyanto, 2018; Yudha, 2019; Brandt & Hagge 2020; Tuor Sartore & Backes-Gellner 2020). Without measurable quality, national development will also be difficult to implement and therefore education is one of the focuses of attention (Darmayasa et al., 2018; Setyawati & Harun, 2021). Higher education is one of the places that provide formal education facilities for the nation's generation (Setyawan & Riadin, 2020; Thoharudin et al., 2019; Siswaya, 2019). At the tertiary level, many faculties can be chosen according to the desired career path, one of which is the faculty of teacher training and education.

The teaching and education faculties form students who in the future will become educators. To become an educator, good character, knowledge, and skills are needed (Arrozi et al., 2021; Sukmawati et al., 2019; Winarsieh & Rizqiyah, 2020; Lundberg, 2022; Kaçaniku, 2023). To achieve this, students must take the lecture seriously. Mathematics Physics II is one of the subjects that must be followed by students of the physics education study program. The purpose of this course is that students can formulate physical processes with mathematical statements and solve them analytically (Gunada et al., 2021; Nurhidayah et al., 2018; Tanjung, 2018). However, this course is known for its difficult and complicated courses (Jannah et al., 2019; Kurniawan & Nasih, 2019; Vivaldy & Sihombing, 2019). The difficulties experienced by students are known because of the source books used in learning.

The sourcebook used in the study is the textbook Mathematical Methods in the Physical Sciences by Mary L. Boas with a thickness of 839 pages, all of which are in English. Students admit that the inability to understand material from source books is one of them due to a limited understanding of English (Dayati, 2021; Fauziah et al., 2017; Abbas & Hidayat, 2018). Therefore, students tend to only use explanations from lecturers (Marzuki & Hakim, 2019; Nusantara & Konsep, 2021; Studi et al., 2018). One effort that can be made is to develop books as a learning resource for Mathematics Physics II for students (Fitriani et al., 2021; Modul et al., 2021; Mulyasari, 2021). One of the developments that can be done is the development of the physics-mathematics e-module II.

The development of e-modules was chosen as one of the solutions to this problem because of its practical and systematic form of presentation. Another advantage of the e-module is that it is interactive so that it can display images, audio, video, and animation and is equipped with formative tests as feedback that can be implemented immediately (Fortuna & Fitria, 2021; Rifa'i & Nisa, 2019; Endang et al., 2021; Peungcharoenkun & Waluyo 2023). The development of this e-module will also improve the quality and convenience of learning (Gunada et al., 2017; Puspitasari, 2019; Rahmawati, 2018; Taghizadeh & Emam 2023). The development of this e-module is expected to be able to overcome problems in mathematics physics lectures II (Mulyono et al., 2022; Ula et al., 2021; Wahyuni et al., 2020). However, researchers also need to know how students view the need for the development of this Mathematics Physics II e-module.

Based on the explanation above, the researcher intends to research to find out how students view the need for the development of the mathematics physics e-module II. The researcher also hopes that this research can become useful reading material for readers and become a good reference for other researchers. The researcher also hopes that this research can overcome the problems that occur in the Physics Mathematics II course. The researcher hopes that this paper

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can be a consideration for the development of an e-module in Mathematics Physics II as additional learning material for students.

This research has been done by previous researchers. One of the researchers conducting needs analysis research on the development of this e-module is Wulandari et al., (2021). This research conducted by Wulandari focuses on analyzing the need for developing an e-module in Mathematics Physics I. Another research conducted by Chen et al., (2022) this research focuses on analyzing the need for the development of a folding integral e-module in the Mathematics Physics I course. , this study has differences from previous studies. This study focuses on investigating the need for developing e-modules for Fourier series material in the Mathematics Physics II course.

1.1. Purpose of the Study

The purpose of the study investigate how much students need for the development of e-modules for the Fourier series material in the Mathematics Physics course.

2. METHOD AND MATERIALS

2.1. Research Methods

This study uses a mixed method (mixed method). According to Iskandar (2021), mixed methods are a method of combining two data derived from quantitative data and qualitative data. This method is divided into 3 parts, namely convergent parallel mixed method, explanatory sequential, and exploratory mixed design (Dwiastuti, 2017). In this study, the researcher used an explanatory sequential mixture method based on quantitative data with qualitative data as support. The stages of this research began with making observations. The purpose of this observation is to see and observe everything related to this research (Kusmana, 2018).

2.2. Participants and ethics

This research was conducted in January 2022 at Jambi University. The population in this study were students of the physics education study program, faculty of teacher training, and education science batch 2020. The samples used in this study were students of regular class A 2020 physics education totaling 36. The participants' oral consent wassought brore they responded to the questionnaire and interviews. The research posed no harm to the participants, the environment or the institutions involved.

2.3. Data collection instruments

In a study, an instrument is needed to obtain and collect data. The instruments used were in the form of questionnaires and interviews. The number of statements used on the questionnaire sheet is 6 statement items with 5 answer choices, namely strongly disagree, disagree, neutral, agree, and strongly agree. The categories and intervals on the questionnaire sheet for the need for the development of the Physics II e-module for students can be seen in Table 1 below.

Table 1

Categories and intervals for the e-module development need a questionnaire

Category	Interval
Very unneeded	6,0 – 10,8
Not needed	10,9 – 15,6
Enough needed	15,7 – 20,4
Needed	20,5 – 25,2
Very needed	25,3 – 30,0

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The researcher also conducted interviews with the grid which was used as an interview guide for the Physics Mathematics II course which can be seen in table 2 below.

Table 2

Student interview grid

Number	Indicator	Number Item
1	Following the process of Physics Mathematics II lectures	1, 2, 3
2	Teaching materials used in lectures	4, 5
3	Constraints or problems in lectures	6, 7
4	Expected solution	8
5	If a module is made, what kind of module is expected	9, 10, 11, 12

2.4. Research Procedure

Because research is an activity that is carried out in a planned and systematic manner, this research is carried out in clear stages (Mukhtazar, 2020). The stages of data collection were carried out by distributing questionnaires on the need for the development of the Physics II e-module to students to obtain quantitative data and conducting interviews with students to obtain qualitative data. Furthermore, the researchers analyzed the data and drew conclusions that closed the research. More briefly, the research procedure can be seen in Figure 1 below.

Figure 1

 Research procedure

At the data analysis stage, the researcher used 2 analytical techniques, namely analysis for quantitative data and analysis for qualitative data. Quantitative data analysis was carried out with the help of the SPSS application. Quantitative data were analyzed using descriptive statistical analysis tests. The use of descriptive statistical analysis tests was chosen because it presents information that is concise and easy to understand (Wahyuni, 2020). Qualitative data analysis was carried out using analytical techniques referring to Miles & Huberman.

3. RESULTS

This research was carried out by the stages that have been described in the method section. Next, the researcher presented the results of the data analysis in this section. Quantitative data analysis was obtained from the SPSS application with the test used was descriptive statistical analysis test. The results of the descriptive statistical analysis of e-development needs Mathematics Physics II module for students can be seen in Table 3 below.

Table 3

Results of descriptive statistical analysis of the questionnaire development needs of e-modules

Interval	F	%	Mean	Minimum	Maximum
6,0 – 10,8	0	0			
10,9 – 15,6	0	0			
15,7 – 20,4	8	22,2	23,5	16,0	29,0
20,5 – 25,2	21	58,3			
25,3 – 30,0	7	19,5			

The results of the descriptive statistical analysis used 5 categories with the lowest intervals to the highest intervals with categories very not needed, not needed, quite needed, needed, and very much needed. Based on the results of the analysis above, it was found that there were no students who stated that the development of the Mathematics Physics II e-module was not needed and not needed with a percentage result of 0%. The results of the questionnaire analysis showed that 8 students stated that the development of the Mathematics Physics II e-module is quite needed with a percentage yield of 22.2%. The majority of students with a total of 21 students stated that the development of the Mathematics Physics II e-module is needed with a percentage result of 58.3%. 7 other students stated that the development of the Physics Mathematics II e-module is very much needed with a percentage yield of 19.5%. The results of the descriptive statistical analysis of the need for the development of the Mathematics Physics II e-module also show that the average value obtained is 23.5, while the minimum and maximum values are 16.0 and 29.0, respectively.

Based on the results of the needs analysis for the development of the Mathematics Physics II e-module, it is known that most of the students stated that the students of the physics education study program at the faculty of teacher training and education at Jambi University needed the development of the Mathematics Physics II e-module as an independent study material. based on the book Mathematical Methods in the Physical Sciences by Mary L. Boas which the entire content of the text is in English. Even though the use of the main source of this book is one of the difficulties for students to understand the material of Mathematical Physics II. This is in line with research conducted by Fitriani (2020) which states in her research that students have difficulty understanding the textbook because it uses English.

Not only that, the researchers also made observations to find out whether the development of the Mathematics Physics II e-module has often been developed or not. in the Mathematics Physics II course. Research conducted by Gunada (2017) developed teaching materials for the compilation of Mathematics Physics II in the form of modules. Other research is also doing the development of e-modules. Unfortunately, the development of the e-module refers to the Mathematics Physics II course. This is in line with the research conducted by Fitriani (2020) who developed the e-module in Mathematics Physics I on partial differential material. Furthermore, the researchers also found out that the development of teaching materials in the form of e-modules in Mathematics Physics II at Jambi University had never been done before. This was evidenced by the semester learning plan (RPS) used that there were no teaching materials in the form of e-modules used in Mathematics Physics II learning. The RPS in question can be seen in Table 4 below.

Table 4

Learning plan for the second semester of Mathematics Physics Study Program Physics Education Faculty of Teacher Training and Education at Jambi University

COURSE LEARNING ACHIEVEMENTS	
Attitude	Have a high curiosity, discipline, sense of responsibility, cooperation, and critical attitude in solving various problems related to Mathematics Physics II material and able to communicate it based on scientific ethics
General skills	Able to study, and determine the appropriate mathematical approach to solving problems in physics
Special skill	a. master knowledge of physics mathematics 2
	b. can choose the right way to solve mathematical physics problems

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	Knowledge	Mastering knowledge and being able to apply concepts
Brief Description		This course studies the concepts of vector analysis, Fourier series, ordinary differential equations, coordinate transformations and tensor analysis.
Study materials: Learning Materials		Vectors, line integrals, Green's theorem on planes, Stoke's Fourier series theorem, complex forms of Fourier series, and their applications in physics. Ordinary differential equations, first-order equations, second-order equations, calculus of variations, Euler equations, coordinate transformations, tensor analysis.
References		M. L. Boas-Mathematical Methods in the Physical Sciences – John Wiley

Then the researchers analyzed the qualitative data obtained through interviews with physics education students at Jambi University. The results of the interviews were conducted using the initials Q which indicates the question and the initials A which indicates the answers from most of the students. physics education, faculty of teaching and education at Jambi University.

Q: Are you currently taking Mathematics Physics II lectures?
A: Yes.
Q: Is this the first time for you to take a Physics Mathematics II course?
A: Yes.
Q: How many times have you attended Mathematics Physics II lectures?
A: 1 time (one semester).
Q: Do you have any sourcebooks used in Mathematics Physics II lectures?
A: Yes, I have.
Q: What do you think about the source books used in Mathematics Physics II lectures?
A: It is difficult to understand because it is in English.
Q: Did you have any problems during the Mathematics Physics II lecture?
A: Yes.
Q: Did one of the obstacles during the Physics Mathematics II lectures lie in the sourcebook used?
A: Yes.
Q: What do you expect from this problem?
A: Hopefully there will be books whose texts are in Indonesian so that students can understand the Physics Mathematics II course material well.
Q: Would you like it if there were Mathematics and Physics teaching materials in the form of electronic modules?
A: Yes, very happy.
Q: What do you think if Mathematics Physics II is made an electronic-based lecture module?
A: Agree, because it will help students learn anywhere and anytime.
Q: Will the Physics Mathematics II electronic module help the lecture process?
A: Yes, of course.
Q: What do you expect from the electronic module?
A: Hopefully the electronic module produced uses the Indonesian language with easy-to-understand explanations and helps students learn Mathematics Physics II independently.

Based on the results of interviews with students of the physics education study program, and the faculty of teacher training and education, it was found that students need an e-module in the Mathematics Physics II course with an easy-to-understand Indonesian language. The students also stated that they had high hopes for the development of teaching materials in the form of e-modules that could be used as a means to study Mathematics Physics II independently. The choice of e-modules as an effort to overcome student difficulties in Mathematics Physics II was not

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without reason. This is because e-modules are a solution for teaching materials as well as independent learning materials for students with a systematic arrangement (Latifah et al., 2020).

4. CONCLUSION

This research is motivated by the difficulties of students in studying Mathematics Physics II with Fourier series material because the main source books used are all in English. Students also admitted that the difficulty in studying Mathematics Physics II was due to the lack of a variety of examples. The study aimed to analyze students' need for the development of e-modules for the Fourier series material in the Mathematics Physics II course.

Based on the results of the research that has been carried out, it can be concluded that the development of the Mathematics Physics II e-module is needed for students of the physics education study program, the faculty of teacher training and education at Jambi University. So far, the use of English has made it difficult for students to understand Mathematics Physics II lecture material. The development of the Mathematics Physics II e-module has also never been done before. Therefore, the development of the Mathematics Physics II e-module is needed to support lectures in the Mathematics Physics course II.

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